

under 35 U.S.C. § 103(a) as being unpatentable over Uz in view of United States Patent No. 5,724,100 to Kuchibhotla.

Uz et al.

Uz is directed to a method for performing rate control in a video encoder which provides a bit budget for each frame while employing virtual buffers and virtual buffer verifiers. (Uz, Title) The rate control has embodiments useful for constant bit rate and a variable bit rate encoding of video frames. (Uz, Abstract) In some cases it may be desirable to use variable bit rate (VBR) encoding. In particular, it may be desirable to provide for non-real time variable bit rate encoding. Such encoding may utilize multiple encoding passes.

Independent Claim 1

Claim 1 recites "calculating a first quantizer step size such that a first number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a first given number of frames starting at a current frame; incrementing the current frame; and calculating a second quantizer step size such that a second number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a second given number of frames starting at the incremented current frame. In order to anticipate a claim, the reference must teach every element as arranged in the claim.<sup>1</sup> The Applicant submits that the Uz language cited by the Office Action regarding claim 1 which states that "the rate control quantization scale factor  $Q_n^R$  for an initial macroblock in the first frame of each type (I, P, B) in the new scene is a function of TA (average total activity), and the bit budget for the frame, i.e.,  $Q_n^R = f(\text{bit budget, TA})$ " (Uz, ¶11 lines 61-64) is limited to describing rate control quantization scale factor  $Q_n^R$  for an initial macroblock in the first frame rather than Applicant's claimed subject matter including

<sup>1</sup> *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990), see M.P.E.P. §2131.

among other things "calculating a first quantizer step size such that a first number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a first given number of frames starting at a current frame; incrementing the current frame; and calculating a second quantizer step size such that a second number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a second given number of frames starting at the incremented current frame." As such, Applicant submits that Uz neither discloses, teaches or suggests the applicant's claimed subject matter.

Applicant submits that Uz rather than disclosing "calculating a first quantizer step size over a first given number of frames starting at a current frame; incrementing the current frame; and calculating a second quantizer step size such that a second number of bits is constant over a second given number of frames starting at the incremented current frame," Uz is limited to calculating a rate control quantization scale factor  $Q_n^R$  for an initial macroblock in the first frame of each type (I,P,B). Further, to the extent Applicant calculates a first quantizer step size and a second quantizer step size, Applicant claims subject matter that is wholly different than that described in Uz, where Uz describes that a rate control quantization scale factor  $Q_n^R$  for an initial macroblock in the first frame of each type is generated. (Uz ¶11, lines 61-62). Further, Applicant submits that nowhere does the Office Action specifically point out where Uz describes, among other things, that "a first number of bits is constant over a first given number of frames starting at a current frame; incrementing the current frame" and "a second number of bits is constant over a second given number of frames starting at the incremented current frame." Because Applicant can find no language in Uz that makes reference to "incrementing the current frame," and further can also not identify language such that "a first number of bits is constant over a first given number of frames starting at a current frame; incrementing the current frame

and such that a second number of bits is constant over a second given number of frames starting at the incremented current frame," Applicant submits that Uz does not disclose, teach or suggest applicant's claimed subject matter. As such, it is respectfully submitted that Uz fails to describe each and every element as arranged in the claims. Consequently, the Office Action fails to show how Uz anticipates claim 1.

### Claim 2

Claim 2 requires "using a second given number of frames that is equal to the first given number of frames." Applicant submits that, as discussed above, Uz nowhere discloses among other things "calculating a first quantizer step size such that a first number of bits is constant over a first given number of frames starting at a current frame; incrementing the current frame; and calculating a second quantizer step size such that a second number of bits generated at an output of the constant-bit-rate finite-buffer-size video encoder is constant over a second given number of frames starting at the incremented current frame." Applicant submits that the Uz language cited by the Office Action regarding claim 2 which states "the number of frames in a GOP (group of pictures) may be fixed or may be variable" is limited to a number of frames that may be fixed or variable, rather than Applicant's claimed subject matter including, among other things, "using a second given number of frames that is equal to the first given number of frames." As such, Applicant submits that Uz neither discloses, teaches or suggests applicant's claimed subject matter. Applicant respectfully reasserts that arguments made above regarding claim 1. In addition, applicant also submits that because claim 2 depends from claim 1, and as a dependent claim therefrom, claim 2 is allowable for the reasons claim 1 is allowable. Applicant further submits, argued in part at least immediately above, that claim 2 is also allowable in light of the presence of novel and non-obvious elements contained in claim 2 that are not otherwise present in claim 1.

**Independent Claim 3**

Applicant submits that the Uz language cited by the Office Action regarding claim 3 which states "let  $S_j Q_j$  be the number of bits and average quantization scale factor used for coding the most recent frame of type  $j$ . Then  $BB_i$ , the bit budget for frame  $i$  is given by" is limited to the number and average quantization scale factor used for coding the most recent frame of type  $j$  rather than Applicant's claimed subject matter including "adjusting a number of bits in a second frame based on the power value for the first frame." As such, Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter. Further, to the extent that Applicant "adjusts a number of bits in a second frame based on the power value for the first frame", Applicant's claimed subject matter is wholly different from that described and Uz as cited, where Uz as cited describes a number of bits and average quantization scale factor used for coding. The Office Action equates calculating a power value to the total activity (TA) in Uz. However, nowhere does Uz as cited describe the total activity (TA) as a power value as asserted in the Office Action. As a result, Uz fails to describe each and every element as arranged in the claims. Consequently Uz as cited fails to anticipate claim 3.

**Claim 6**

Applicant submits that the Uz language cited by the Office Action regarding claim 6, which states that "the displaced frame difference activity (DFDA) is the total activity calculated in the manner described above in Section B of the macro block of pixel error values resulting from subtracting the motion compensated prediction of a macro block from the macro block to be encoded" is limited to the calculation of pixel error rather than Applicant's claimed subject matter including, among other things "calculating a sum of absolute values of the pixel level error values for a pixel block." As such, Applicant submits that Uz neither discloses, suggests or teaches Applicant's claimed subject matter.

Further, to the extent that Applicant calculates a sum of absolute values, Applicant's subject matters is wholly different than that described in Uz where Uz describes the calculation of the pixel error values resulting from subtracting the motion compensated prediction of a macro block from the macro block to the encoded and as such does not mention, among other things, the calculation of a absolute value (Uz ¶9, lines 23-27). Applicant notes that the Office Action equates the calculated sum of absolute values of the pixel level error with the displaced frame difference activity (DPDA), however, Uz makes no mention of any type of absolute value calculation as required in the claims.

Applicant submits that the Uz language cited by the Office Action which states that the inter-intra decision for the macro block and is determined as follows: is limited to the determination if a block is either an inter block or an intra block rather than "calculating an expected number of bids for the pixel block based on the sum of the absolute values" as stated above since Uz as cited fails to describe the calculation of a sum of absolute values of the pixel level error, then Uz fails to also calculate an expected number of bids for the pixel block based on the sum of the absolute values. As a result, Applicant's claimed subject matter is wholly different than that described in Uz where Uz describes merely the selection, the determination of whether a macro block is either inter or intra (Uz ¶ 9, lines 38-42).

Applicant, directing the Examiner's attention to Applicant's discussion of Uz above, respectively submits that Uz nowhere discloses "using the expected number of bits for the pixel block to obtain constant bit rate video encoding." Further the Office Action's reference to column 12 of Uz makes no mention of "using the expected number of bids for the pixel block to obtain constant bit rate video encoding." Applicant respectively requests that if the Examiner maintains the rejection of claim 6 based on Uz as cited, the Examiner is requested to show where

in column 12 Uz describes "using the expected number of bids for the pixel block to obtain constant bit rate video encoding."

**Dependent Claims 6, 7, 8 and 24**

Applicant respectively reasserts the arguments made above regarding claim 6. Applicant submits that claims 7, 8 and 24 are allowable for at least the same reasons discussed above regarding claim 6. Applicant submits that because claims 7 and 8 depend from claim 6 and as dependent claims therefrom, claim 7 and 8 are allowable for the reasons claim 6 is allowable. Applicant further submits that claims 7 and 8 are allowable in light of the presence of novel and nonobvious elements contained in claims 7 and 8 that are not otherwise present in claim 6. As such, Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter.

**Claims 11, 12, 13 and 14**

Applicant submits that the Uz language cited by the Office Action regarding claims 11-14 which states constant bit rate (CBR) rate control is achieved through a feedback mechanism by monitoring bit spending and appropriately adjusting the quantization step size, is limited to monitoring bit spending and appropriately adjusting the quantization step size, rather than "predicting a relationship between a quantizer scale factor and a number of encoded bits of a pixel block based on a known relationship in previous pixel blocks of a same type." As such, Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter.

Further, to the extent that Applicant predicts a relationship between a quantizer scale factor and a number of encoded bits of a pixel block based on a known relationship in previous pixel blocks of a same type, Applicant's claimed subject matter is wholly different than that described in Uz where Uz describes rate control by monitoring bit spending and adjusting the

quantization step size. Further, Applicant submits that nowhere in the Office Action does the examiner specifically point out where Uz describes "predicting a relationship between a quantizer skill factor and a number of encoded bids of a pixel block based on a known relationship in the previous pixel blocks of a same type." Because the Applicant can find no language in Uz as cited that makes reference to the above-cited claim language, and further, can also not identify language tying the relationship of the known relationship in previous pixel blocks of a same type, among other things, Applicant submits that Uz does not disclose, teach or suggest Applicant's claimed subject matter. As such, it is respectfully submitted that claims 11-14 are allowable as written.

#### **Claims 15-18**

Regarding claims 15-18, the Uz language cited in the Office Action states " $C_i(K)$  is the complexity measure for Section K for frame type I "is limited to a complexity measure rather than "using the group of pictures level prediction, the picture level prediction, and the pixel-block-level prediction to adjust a quantizer scale factor." Applicant submits that the additional Uz language cited by the Office Action regarding claims 15-18 which states "default values are used to establish budgets for I, P and B frames rather than basing the budgets on the previously coded frame of the same type. The budgets are established so that the budget for an I frame is twice the budget for a P frame and four times the budget for a B frame. The budget for the I frame is determined from factors such as intra-activity and VBV occupancy, "is limited to establishing budgets for I, P and B frames rather than basing the budgets on the previously coded frame of the same type." As such, the Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter.

Applicant respectfully requests that the Examiner specifically show where in column 12 that Uz describes "calculating the picture level prediction for the number of bits encoded for the pictures based on a pixel block type."

Applicant submits that the Uz language cited in the Office Action regarding claim 16, which states that "the motion estimation score of a macro block is, for example, a sum of the absolute differences of the pixels in the macro block and the corresponding pixels in the prediction of the macro block in the reference frame" is limited to the sum of the absolute differences of the pixels in the macro block and the corresponding pixels in the prediction, rather than Applicant's claimed subject matter "a sum of absolute values of pixel level error values and a pixel block complexity." As such Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter. The Applicant request that the Examiner clarify the Examiner's assertion that the pixel block complexity corresponds to claim 16 where the Examiner previously asserted that the total activity corresponds to a power value as shown in the Office Action on page 3, line 1. As such, the Examiner is equating the total activity to two completely different parameters namely the power value for one claim and the power value with respect to claim 3 and the pixel block complexity with respect to claim 16. With respect to claims 16, 17 and 18 Applicant respectively reasserts the arguments made above regarding claim 15. In addition, Applicant also submits that because claims 16, 17 and 18 depend from claim 15 claims 16, 17 and 18 are allowable for the reasons claim 15 is allowable. Applicant further submits, argued in part at least immediate above, that claims 16, 17 and 18 are allowable in light of the presence of novel and nonobvious elements contained in claims 16, 17 and 18 that are not otherwise present in claim 15.



**Independent Claim 19**

Applicant submits that the Uz language cited by the Office Action regarding claim 19, which states that "a scene change is detected if the deviation from average of TA<sub>i</sub> in a particular frame and the deviation from average of the motions estimation score in the particular frame exceed their expected deviations by a threshold factor (example, a factor of 10) a scene change is detected" is limited to detecting a scene change based on the deviation from average of the motion estimation score exceeding a threshold factor rather than Applicant's claimed subject matter "obtaining a scene change indication from a predication error image; and using the scene change indication to reset a global complexity history; and using the global complexity history to provide the rate control for the video encoder." As such, Applicant submits that Uz neither discloses, teaches or suggests Applicant's claimed subject matter.

**Independent Claim 4**

Claim 4 is rejected under 35 U.S.C. § 103(a) based on Uz. It is well-established that to establish *prima facie* obviousness, all the claim limitations must be taught or suggested by the prior art. In addition, there must be some teaching, motivation or suggestion in either the prior art, or the references themselves to make the combination asserted by the Examiner.

The Uz language cited describes "the frame activity or field activity for a block is determined by summing the absolute differences of horizontal pixel pairs and vertical pixel pairs." (Uz ¶ 8, lines 51-53.) However, this cited portion of Uz is limited to calculating frame activity determined by summing the absolute differences of horizontal pixel pairs and vertical pixel pairs rather than "calculating a sum of absolute differences between the pixel values in the respective pixel block and the average value."

Accordingly, Applicant cannot find where using describes "for each of the plurality of pixel blocks, calculating a sum of absolute differences between the pixel values and their

respective pixel block and of the average value; and adding each sum of the absolute differences for each of the plurality of pixel blocks within the first frame to obtain a power value for the first frame. Contrary to the assertion in the Office Action that the cited portion of Uz describes calculating a total activities, the cited portion of Uz actually teaches the calculation of frame activity rather than total activity (¶ 8, lines 51-64). In contrast to the Applicant's claimed invention, Applicant cannot find where Uz discloses or makes obvious a method or system relating to calculating a sum of absolute differences between the pixel values and the respective pixel block and to the average value and adding each sum of the absolute differences for each of the plurality of pixel blocks within the first frame to obtain the power value for the first frame.

In reviewing the Office Action, the Examiner asserts "it would be obvious to one skilled in the art at the time of the invention to calculate the average for each block or each frame as this decision would be based on the required accuracy of the encoder, storage space and computation time."

Case law makes it clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.<sup>2</sup> Combining prior art references without evidence of such a suggestion, teaching or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability – the essence of hindsight.<sup>3</sup> Evidence of a suggestion, teaching or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some

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<sup>2</sup> In re Dembiczak, 50 USPQ 2d 164, 1617 (Fed. Cir. 1999).

<sup>3</sup> Id.; See, e.g., Interconnect Planning Corp. v. File, 774 F.2d 1132, 1138, 227 USPQ 543, 547 (Fed. Cir. 1985).

cases, from the nature of the problem to be solved, although "the suggestion more often comes from the teachings of the pertinent references."<sup>4</sup> ("The Board must identify specifically . . . the reasons one of ordinary skill in the art would have been motivated to select the references and combine them"). The showing of such suggestion, teaching, or motivation must be clear and particular.<sup>5</sup> Broad conclusory statements regarding the teaching of multiple references, standing alone, are not "evidence."

As previously stated, the Examiner asserts that it would have been obvious to one skilled in the art to calculate the average for each block or each frame as this decision would be based on the required accuracy of the encoder, storage space and computation time. With regard to the Examiner's assertion of the motivation of skilled in the art to modify the system of Uz, a careful examination of Uz as cited reveals that Uz, rather than teaching "calculating a sum of absolute differences between the pixel values and their respective pixel block and the average value" Uz instead teaches calculating a field activity for a block determined by summing the absolute differences of horizontal pixel pairs and vertical pixel pairs. (Uz ¶ 8, lines 51-53). Rather than teaching calculating a sum of absolute differences between the pixel values and the respective pixel block and the average value, Uz teaches summing the absolute differences of horizontal pixel pairs and vertical pixel pairs. As such, Uz teaches merely summing the absolute differences of horizontal pixel pairs and vertical pixel pairs rather than calculating a sum of absolute differences between the pixel values and the respective pixel block and the average

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<sup>4</sup> Dembiczak, 50 USPQ 2d 164, 1617 (Fed. Cir. 1999); In re Roffet, 149 F.3d 1350, 1359, 47 USPQ 2d 1453, 1459 (Fed. Cir. 1998)

<sup>5</sup> Dembiczak, 50 USPQ 2d 164, 1617 (Fed. Cir. 1999); See, e.g., C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1352, 48 USPQ 2d 1225, 1232 (Fed. Cir. 1998).

value. As such, Uz fails to calculate the difference between the pixel values and the respective pixel block and the average value, as acknowledged in the Office Action.

Additionally, the Examiner provides no rationale or explanation for the assertion that to calculate the average value for each block or each frame as this decision would be based on the required accuracy of the encoder, storage space and computation time. As previously stated, the motivation to modify Uz must come from the prior art and not from the Applicant's disclosure.

Uz teaches resolving a completely different problem than the claims, since Uz merely teaches calculating frame activity for a block determined by summing the absolute differences of horizontal pixel pairs and vertical pixel pairs rather than calculating the power value for the first frame based on calculating a sum of absolute differences between the pixel values and the respective pixel blocks and the average value; and adding each sum of the absolute differences for each of the plurality of pixel blocks within the first frame to obtain a power value for the first frame. Accordingly, since Uz teaches calculating frame activity for a block determined by summing the absolute differences of horizontal pixel pairs and vertical pixel pairs, Uz teaches away from the claims because the basis of the calculations in Uz are limited to summing the absolute differences of horizontal pixel pairs and vertical pixel pairs rather than calculating a sum of absolute differences between the pixel values and the respective pixel block and the average value. As such, since Uz teaches away from the claims, one skilled in the art would not be motivated to modify Uz as suggested in the Office Action to perform the power value calculations as claimed.<sup>6</sup>

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<sup>6</sup> A prior art reference must be considered in its entirety, i.e. as a whole including portions that would lead away from the claimed invention. (W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) MPEP 2141.02).

Accordingly, taken into proper context, Uz teaches the avoidance of the calculation of an average value of the pixel value in each of the plurality of pixel blocks within the first frame because Uz merely teaches calculating the frame activity, rather than the total activity based on the absolute differences of horizontal pixel pairs and vertical pixel pairs. Therefore, taking the teachings of Uz into proper context shows that Uz teaches the mere summing of the absolute differences of horizontal pixel pairs and vertical pixel pairs. Accordingly, not only does Uz teach away from the calculation of the power value, such a modification as asserted in the Office Action would change the principal of operation of Uz because it would unnecessarily add complexity to the frame activity determination and increase computation time, rather than provide any benefit with regard to computation time as asserted in the Office Action (Office Action dated September 24, 2003, p. 5, lines 6-9).

Additionally, one would not have any reasonable expectation of successfully reproducing the claimed invention if so modified. Applicant respectfully submits that the Examiner has misinterpreted Uz and merely attempted to reconstruct the subject matter in Claim 4 rather than pointing to specific information in Uz that suggests the modification to Uz. Applicant respectfully submits that the Examiner's obviousness analysis is limited to a discussion of the way Uz can be modified to read on the claim based on motivation obtained from the Applicant's disclosure, rather than from the prior art references themselves. Further, the alleged reference-by-reference and limitation-by-limitation analysis fails to demonstrate how Uz teaches or suggests the combination to yield the claimed invention. As a result, Applicant submits that the Office Action fails to establish a *prima facie* case of obviousness for the claims.

#### Claims 21 and 22

As acknowledged in the Office Action, Uz does not teach the use of including the method and apparatus or the use of this method in a constant bit rate finite buffer size video encoder.

Further the Uz language cited "the result of the first pass and code is a number of bits  $B_i$  is limited to calculating a number of bits rather than determining a power value as asserted in the Office Action. (§ 20, lines 66-67). Additionally, the language cited in Uz describes a feedback mechanism used to account for deviations between  $BU_i$  the actual number of bits used to code frame  $i$  and  $BB_i$  the bit budget for frame  $i$ . (Uz § 22, lines 24-26). Rather than teaching "a group-of-pictures-level rate control block operatively coupled to the processing stage to receive the power value and to provide a target quantizer step size used to provide rate control for the video encoder, Uz instead teaches calculating an actual number of bits used to code a frame. Since Uz as cited, fails to describe each claim element as arranged in claim 21, the Office Action fails to establish a *prima facie* case of obviousness. Further, the assertion in the Office Action that "it would be obvious to one skilled in the art at the time of the invention to include Uz' variable bit rating coding method using the feedback mechanism to provide a simple constant bit rate video and coding apparatus" fails to establish a *prima facie* case of motivation to modify Uz to describe each and every element as arranged in Claim 21. As a result, Applicant submits that the Office Action fails to establish a *prima facie* case of obviousness for claims 21 through 22. Additionally, Applicant repeats the same remarks above.

#### Dependent Claim 20

The Office Action acknowledges that Uz does not teach the method of counting a first number of intra coded pixel blocks in the prediction error image counting a second number of non-intra coded pixel blocks in the prediction error image and calculating a ratio of the first number and the second number; comparing the ratio to a threshold to determine a result and using the result as a scene change indication.

The Kuchibhotla language as cited teaches if the predicted macro block is substantially similar to the input macro block, the residuals are relatively small and are easily coded using

very few bits and (Kuchibhotla, ¶2, lines 36-38) is thus limited to the discussion of the use of a relatively small number of bits if the predicted macro block substantially similar to the input macro block. As such, Kuchibhotla fails to describe each and every step as stated above with respect to claim 20. Further, the Kuchibhotla language cited at ¶3, lines 5-67, merely describes "when a scene change occurs, the anchor pictures are substantially different from the current picture, hence the predicted macro blocks are very inaccurate and the residuals are large."

(Kuchibhotla, ¶ 3, lines 52-57). As such, neither portion of Kuchibhotla as cited teaches each and every element as asserted in the Office Action, as a result, the Office Action again fails to establish a *prima facie* case of obviousness for Claim 20 or for any of the claims.

**Dependent Claims 25 and 26 and Independent Claim 27**

The Office Action acknowledges that Uz fails to teach determining of intra versus non-intra blocks. Applicant respectfully repeats the relevant remarks made with respect to the above claims. The Applicant asserts that the Office Action fails to establish how the combination of Uz and Kuchibhotla describe each and every element of the claims as arranged. Furthermore, the Office Action fails to show how Uz and Kuchibhotla describe, among other things, "a prediction error image to determine L1 distances according to sums of absolute differences; a complexity estimator block coupled to the prediction error image block to determine non-intra pixel block complexity values and intra pixel block complexity values; and a number-of-bit predictor operatively coupled to the prediction error image block to receive the L1 distances and to the complexity estimator block to receive the non-intra pixel block complexity values and the intra pixel block complexity values, the number-of-bit predictor to predict a number of bits generated by the video encoder." Applicant respectfully notes that Claims 25 and 26, dependent upon Claim 24, either directly or indirectly, contains additional patentable non-obvious subject matter and is in proper condition for allowance.

Applicant respectfully request that the pending claims be allowed to issue. Should the Examiner wish to discuss any aspect of the invention, the Examiner is invited to contact the undersigned at his convenience directly at (312) 609-7970.

Respectfully submitted,

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